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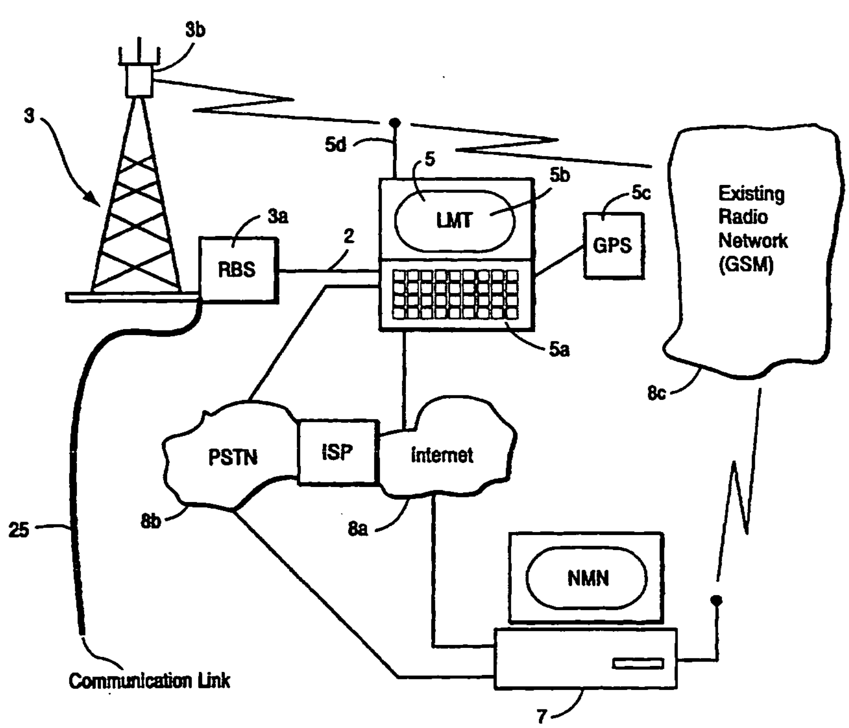
(54) Title: SYSTEM AND METHOD FOR INITIALLY CONFIGURING A NODE OF A CELLULAR TELECOMMUNICATIONS NETWORK





(57) Abstract: A portable Local Mangement Terminal (LMT), or a position sensor connected thereto, is provided at a location geographically proximate to a new node to be initially commected to a network. The LMT may also be referred to as an initial configuration terminal (ICT). The LMT is equipped with a type of geographic position detecting function, e.g., Global Positioning System (GPS) capability. The LMT is caused to establish communication with a network managment node. The LMT determins its geographic position (e.g., via GPS), and forwards position data relating thereto to the network management node. The management node utilizes the position data associated with LMT to determine where the LMT and new node are located, and identifies the new node via this position data. Upon identifying the new node, the mangementt node determines initial site configuration data for the new node and forwards it to the LMT. In turn, the LMT transfers the initial site configuration data to the new node in order to initially configure the node. Following initial configuration of the new node, further configuration of the node can be carried out utilizing at least a part of the initial configuration data.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# SYSTEM AND METHOD FOR INITIALLY CONFIGURING A NODE OF A CELLULAR TELECOMMUNICATIONS NETWORK

This invention relates to a system and method for initialing configuring a node (e.g., base station or radio network controller) of a cellular telecommunications network. More particularly, this invention relates to a system and method which utilizes position or location data of a terminal proximate the new node in the process of initially configuring the new node.

## BACKGROUND OF THE INVENTION

Networks (e.g., Internet Protocol (IP) networks) typically include a number of interconnected nodes. A network may include a plurality of subnetworks, each network including one or more such nodes. Nodes are usually either "hosts" or "routers." A "host" is end-user equipment which originates and receives packets (e.g., IP packets). A personal computer (PC) is an example of a host. On the other hand, a "router" is equipment which routes and forwards packets (e.g., IP packets) to their destination(s). A router is often characterized as a computer that attaches two or more subnetworks/networks or devices and forward packets from one to the other. In a non-limiting example of an IP network, a router uses the destination IP address of an IP datagram or message to choose where to forward that datagram or message.

Often, there are a vast number of hosts in a network, but not so many routers. It is known to automatically configure a host upon its connection to a network. For example, a host may be connected to a network port and configuration data can be automatically downloaded to the host from a Dynamic Host Configuration Protocol (DHCP) server. For example, see U.S. Patent No. 5,884,024, the disclosure of which is hereby incorporated herein by reference. A DHCP type of automatic host configuration may enable savings of time and/or expense for system administrators of large networks that include many hosts.

Unfortunately, manual techniques are currently used to configure routers upon their respective connections to a network. Such manual configuration may be in the form an on-site configuration by a command line interface, or remotely via Simple

Network Management Protocol (SNMP) or Common Object Request Broker Architecture (CORBA). Problems arise in the context of building and/or administering an IP-network including many routers (e.g., hundreds or even thousand of routers). Manual router configuration in such vast networks can become undesirably burdensome as to time and/or cost. Moreover, the more routers in a network to be manually configured, the greater the risk of configuration error by an operator during the configuration process.

For purposes of example only, consider a cellular telecommunications network. Nodes thereof (e.g., base stations and/or radio network controllers) must be initially configured upon their initial installation into the network. Typically, minimum initial configuration provides the new node with a communication channel to a location (e.g., network management center) from which further configuration data/information can be fetched and/or carried out. The initial configuration data may include, for example and without limitation, 1) the provision of an IP address to the new node, 2) the provision of a site identifier to the new node, and/or 3) configuration of an Asynchronous Transfer Mode (ATM) communication layer for the new node. Conventional initial configuration of such a new node in a cellular telecommunications network often requires several manual operator interventions, which increases the risk for human error during the initial configuration process.

U.S. Patent No. 5,706,014 discloses a GPS downloadable interface locator. According to the '014 patent, a GPS receiver is connected to an interface at a base station of a cellular communications network. The GPS receiver determines coordinates which may be transmitted by the base station to a maintenance control center of the wireless network. Thereafter, the network is monitored for non-responsive radio ports (e.g., failure of a radio port in a cell). When a non-responsive radio port is detected, the exact location can thus be reported to the maintenance control center due to the GPS coordinates. Unfortunately, the '014 patent does not recognize the problem of initial site configuration of a node. To the contrary, the '014 patent is unrelated to such problems, and provides no solution therefor.

As will be appreciated by those of ordinary skill in the art, there exists a need in the art for a system and/or method for reducing and/or minimizing the risk of human error during the initial configuration of a new node upon its connection to a network. For the example of a cellular telecommunications network, there exists a need in the art for a system that enables routers (i.e., base stations and/or radio network controllers often perform routing functions in such networks) to be more easily initially configured upon connection to a network.

## SUMMARY OF THE INVENTION

An object of this invention is to provide a system and/or method for reducing the likelihood human error during initial configuration of a node upon the node's connection to a network.

In an exemplary embodiment of this invention, a portable initial configuration terminal (ICT) or (also referred to as a Local Management Terminal (LMT)), and/or a geographic positioning sensor attached to the ICT or LMT, is provided at a location proximate to a new node to be initially connected to a network. The new node is to be initially configured. The LMT, and/or the sensor in communication therewith, is equipped with a type of geographic position detecting function, e.g., Global Positioning System (GPS) capability. Upon positioning the same (i.e., the LMT and/or the positioning sensor in communication with the LMT) geographically proximate the new node, the LMT is caused to establish communication with a network management node. This communication between the LMT and network management node may be via an existing network such as the Internet, the Public Switched Telephone Network (PSTN), an existing radio network such as GSM, or any other suitable communication media. The LMT determines the geographic position of the LMT (when the LMT is located proximate the new node) and/or of the sensor in communication with the LMT (when the sensor is located proximate the new node), and forwards position data relating thereto to the network management node. The management node utilizes the position data associated with LMT (or sensor in communication with the LMT) to determine where the LMT (or sensor in communication with the LMT) and new node are located.

The management node may identify the new node in such a manner by knowing its approximate geographic position/location.

Upon identifying the new node, the management node determines initial site configuration data for the new node and forwards such data to the LMT. In turn, the LMT transfers the initial site configuration data to the new node via an interface (e.g., via an RS-232 interface, an Ethernet connection, a radio interface, or any other suitable interface/connection). Following such an initial configuration of the new node, further configuration of the node can be carried out utilizing at least a part of the initial configuration data provided to the new node via the LMT.

Thus, initial site configuration of a new node connected to a network can be carried out more easily according to different embodiments of this invention. Initial configuration may be carried out by almost anyone (i.e., skilled and/or unskilled technicians) in a versatile manner, because the initial site configuration is largely automatic and few manual procedures are required of a person(s) implementing this task. Accordingly, the likelihood of human error during the initial configuration of a new node is reduced.

This invention may be implemented in the context of a cellular telecommunications network (e.g., the new node to be initially configured may be a base station, radio network controller, or the like in such a network). However, the invention is not so limited, and may also be implemented in other types of networks.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a flowchart illustrating certain steps performed during the course of initially configuring a new node being added to a network, according to an exemplary embodiment of this invention.

Figure 2 is a functional block diagram of certain elements/components utilized in the process of Figure 1.

Figure 3 is a functional block diagram of a system and/or method for initialing configuring a new node upon its connection to a network according to an embodiment of this invention.

Figure 4 is a functional diagram illustrating a cellular telecommunications network in the context of which certain exemplary embodiments of this invention may be implemented.

Figure 5 is a diagram of a plurality of cells in the network of Figure 4, the cells being illustrated as square-shaped for purposes of simplicity only.

Figure 6 is a diagram of the protocol structure of a new node connected to the network of Figures 4-5, after the new node has been configured.

Figure 7 is a schematic diagram illustrating how a new node may be initially configured upon its connection to an IP network including a portion of the UTRAN of Figure 4.

Figure 8 is a block diagram of an exemplary LMT (or ICT) according to an embodiment of this invention.

Figure 9 is a functional block diagram of another embodiment of this invention.

## DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THIS INVENTION

In the following description, for purposes of explanation and not limitation, specific details are set forth in order to provide an understanding of certain embodiments of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances, detailed descriptions of well-known devices, circuits, OSI models, protocols, and methods are omitted so as to not obscure the description of the present invention with unnecessary detail. Referring now more particularly to the accompanying drawings, in which like reference numerals indicate like parts/elements throughout the several views.

According to an exemplary embodiment of this invention, a new node (e.g., base station (BS) or radio network controller (RNC)) is initially connected to an existing network (e.g., cellular telecommunications network). A portable local management terminal (LMT), which includes a computer and appropriate communication interfaces (e.g., RS-232, Ethernet, radio (wireless via an antenna), Internet, and/or PSTN), is geographically positioned at a location proximate the new node according to certain embodiments. In other embodiments, a geographic position determining sensor in communication with the LMT may instead be positioned proximate the new node so that the LMT itself may either be located distant from the new node or proximate the new node. A LMT may also be referred to herein as an initial configuration terminal (ICT). For example, in the context of a new base station (BS) being added to a cellular telecommunications network, a technician may transport the LMT (or sensor in communication therewith) into the field to a location at or adjacent to the new base station to be added to the network. The LMT determines its geographic location (e.g., via GPS, GSM, or any other suitable geographic positioning system). The LMT forwards its location to a network management node (NMN) via an existing communications media such as the Internet, Ethernet, PSTN, or existing radio network such as GSM. The management node of the network uses the LMT's geographic position to identify the particular new node to be added to the network (i.e., the management node assumes that the new node to be initially configured and the LMT are geographically proximate one another). Thus, by knowing where the LMT (or sensor in communication therewith) is located geographically, the management node determines which new node is in the process of being initially configured by the LMT.

Upon identifying the new node, the management node determines initial configuration data for the new node (e.g., from a look-up table in memory) and forwards the same to the LMT. The LMT in turn forwards this initial configuration data (e.g., IP address, site identify, and/of configuration of an ATM communication layer) to the new node via an existing interface (e.g., an RS-232 interface, a local Ethernet connection/interface, a dedicated service channel via a radio interface, etc.). The new node receives the initial configuration data and stores the same in memory.

The new node is now initially configured. Using at least a portion of this initial configuration data, the new node can then carry out further configuration automatically (e.g., downloading of router protocol from a server or other node in the network).

Referring to Figures 1-2, an exemplary embodiment of this invention is described and illustrated. New node 3 is to be connected to an existing network, and initially configured. A portable LMT (or ICT) 5 is positioned proximate the new node 3 which is to be configured via the LMT (see step 9 in Figure 1). Dotted line 6 in Figure 2 illustrates a geographic area associated with the new node 3 (e.g., area 6 may be a cell corresponding to a new base station node to be added to the network, or any other area proximate the geographic position of the new node). In step 9, LMT 5 is positioned within geographic area 6, so that it is geographically proximate to the new node 3. Preferably, if the LMT is located in area 6, it will be closer to node 3 than to any other node in the network. In this embodiment, the LMT 5 includes a geographic position sensor or detector.

LMT (or ICT) 5 then establishes communication with a Network Management Node (NMN) (see step 11 in Figure 1). This communication between the LMT 5 and Network Management Node (NMN) 7 may be established over a communication media 8 such as the PSTN, the Internet, an existing radio network such as GSM, or any other suitable communications media.

In embodiments where LMT (or ICT) 5 has GPS capability, the LMT communicates with GPS satellite(s) 4 in a known manner in order to determine a relatively precise geographic location of the LMT. GPS is a known satellite based system for establishing geographic locations/positions. Numerous GPS satellites 4 are dispersed in orbit(s) around the planet Earth. Multiple GPS satellites are often visible from numerous geographic locations on the Earth's surface, and access to multiple such satellites can be used to determine a GPS receiver's location at or near the Earth's surface. In general, a GPS receiver (part of a position sensor or detector) of LMT 5 receives signals from a plurality of different GPS satellites 4. Intervals between transmission and/or reception of satellite signals may be used by the LMT to calculate the LMT's distance from each satellite. Such distances may be used in known

algorithms to compute a geographic location/position of the LMT 5 (see step 13). While GPS is a preferred way for LMT to determine its location/position in certain embodiments, this invention is not so limited as other suitable location determining methods/systems may be used instead of GPS. For example, a GSM based geographic positioning system (free of satellites) or any other types of geographic positioning system may be used according to this invention instead of GPS.

After determining its position, LMT 5 forwards data indicative of its geographic location (e.g., determined by GPS) to network management node (NMN) 7 over communications media 8 (see step 15).

NMN 7 receives the data from LMT (or ICT) 5 indicating the LMT's geographic location. NMN 7 uses this geographic location data of the LMT to determine the identification (ID) of the new node 3 to be configured by the LMT 5 at issue (see step 17). Upon identifying the node 3 to be initially configured, NMN 7 determines initial configuration data for the same. Upon determining the appropriate initial configuration data for the new node, NMN 7 sends this initial configuration data to LMT 5 via communications media 8 (see step 19). In turn, LMT 5 receives this initial configuration data and forwards/transfers the same to new node 3 via a communications media/interface 2 (see step 21). Media/interface 2 may be, for example, an RS 232 interface, a local Ethernet interface/connection, a dedicated service channel via a radio interface, or any other suitable interface/media. The new node 3 receives the initial configuration data, and stores the same in memory. Optionally the new node may utilize at least a portion of this initial configuration data in order to carry out further configuration automatically (e.g., see step 23).

Figure 8 is a block diagram of an exemplary LMT (or ICT) according to an embodiment of this invention. As shown, the LMT includes a processor, a memory, a GPS receiver, a display, a keyboard, and respective interfaces for communicating with the management node and new node to be initially configured.

Figure 3 is a functional block diagram illustrating an embodiment of this invention in which LMT (or ICT) 5 is utilized in order to initially configure a new base

station (BS) 3a, 3b being added to a cellular telecommunications network. As illustrated, LMT 5 includes keyboard 5a, display (e.g., CRT or LCD) 5b, GPS receiver 5c, and antenna 5d for communicating with the base station and/or other elements via wireless channel(s) such as via a radio network like GSM. As will be recognized by those skilled in the art, LMT 5 further includes an appropriate processor(s) and memory(ies) for storing appropriate programs, configuration information, network information, and the like. As illustrated, the new radio base station (BS or RBS) to be added to the network includes a computer based terminal 3a as well as a transceiver 3b for communicating with LMT 5 and/or Mobile Stations (MS) with which the base station (BS) is to communicate after its installation.

Still referring to Figure 3, LMT (or ICT) 5 is positioned proximate the new base station 3a, 3b to be added to the network. LMT 5 establishes communication with Network Management Node (NMN) 7 via communications media 8 such as the Internet 8a, the PSTN 8b, and/or an existing radio network such as GSM 8c. LMT 5 provides NMN 7 information/data indicative of the LMT's geographic location via communications media 8. In turn, NMN 7 determines the identification of base station 3a based at least part upon the geographic location of LMT 5. NMN 7 determines the appropriate initial configuration data for the new base station and forwards the same to LMT 5 over communications media 8. Upon receiving the initial configuration data, LMT 5 transfers this initial configuration data to base station 3 via interface/media 2. Upon being initially configured in such a manner, the new base station can optionally contact NMN 7 and/or any other appropriate node in the network via communication link 25 (wired or wireless) in order to perform further configuration functions.

Thus, initial configuration of the new base station in the Figure 3 embodiment may be performed with reduced risk of technician error during the configuration process. This is because of the largely automated procedures associated with initial configuration. In preferred embodiments, little or no manual procedure is required for initial configuration, prior to the site visit to the new node (e.g., base station) by a technician with LMT 5.

In order to more fully explain the embodiment of Figure 3 as well as other embodiments of this invention, reference is made to the cellular telecommunications network illustrated in Figure 4. In particular, new nodes 3 to be added to networks herein may be respective nodes of the Universal Mobile Telecommunications System (UMTS) 31 of the Figure 4 network. Referring to Figure 4 in general, a representative circuit-switched external core network 33 may be, for example, the PSTN and/or the Integrated Service Digital Network (ISDN). Another circuit-switched external core network may correspond to the Public Lan Mobile Radio Network (PLMN) 35. A representative packet-switched external core network 37 may be, for example, an Internet Protocol (IP) network such as the Internet. The core networks may be coupled to corresponding network service nodes 39. The PSTN/ISDN network 33 and other PLMN network(s) 35 may be connected to a circuit switched core node 41, such as a Mobile Switching Center (MSC), that provides circuit switched services. It is further noted that UMTS 31 may coexist with an existing cellular network, such as the Global System for Mobile communications (GSM) where MSC 41 is connected over an interface 45 to a base station subsystem 47 which in turn is connected to at least one radio base station 49 over an interface 51.

Packet switched network 37 may be connected over interface 53 to a Packet Switched Core Node (PSCN), e.g., a General Packet Radio Service (GPRS) node 55 tailored to provide packet switched type services. Each of core network service nodes 41 and 55 connects to UMTS Terrestrial Radio Access Network (UTRAN) 57 over a radio access network interface 58. The UTRAN 57 includes one or more Radio Network Subsystems (RNS) 59 each with at least one Radio Network Controller (RNC) 61 coupled to a plurality of base stations (BS) 63 and/or to other RNCs (e.g., via 64) in the UTRAN 57. As will be appreciated by those of skill in the art, implementation of certain embodiments of this invention may be for initial configuration of nodes (e.g., base station 63 and/or RNC node 61) within UTRAN 57. The UTRAN may utilize an IP network so as to allow respective nodes therein to communicate with one another. Thus, the new base station 3a, 3b added to the network in the Figure 3 embodiment may correspond to a new base station 63 to be added to the UTRAN of Figure 4.

Still referring to Figure 4, radio access over radio interface 71 may be based upon Wideband Code Division Multiple access (WCDMA) with individual radio channels allocated using WCDMA channelization or spreading codes. Of course, other access methods may instead be employed, such as TDMA and/or other types of CDMA. WCDMA provides wide bandwidth for multi-media services and other high transmission rate demands, as well as robust features such as diversity handoff to ensure high quality communication service in frequently changing environments. Each base station 63 may communicate with a plurality of mobile stations (MS) 73 over interface 71, using common and/or dedicated radio channels.

UTRAN 57 is made up of a large number of nodes which may function in an IP network. For example, each base station (BS) 63 and each RNC 61 in UTRAN 57 is a node, with each of these nodes may function as an IP router in the network. The IP network thus utilizes the infrastructure of the UTRAN. IP packets are transported over Asynchronous Transfer Mode (ATM) connections between nodes (e.g., between base stations, between RNCs, and/or between a base station and RNC). Moreover, in certain embodiments of this invention, IP based management systems may be connected to nodes in UTRAN 57 via Ethernet Local Area Networks (LAN) attached to physical Ethernet interfaces on UTRAN nodes. Thus, many if not all UTRAN nodes (e.g., 61, 63) can contain IP host and router functionality which makes it possible to send IP packets to any node in the UTRAN, and reach it/them via routing in intermediate nodes. IP support within UTRAN 57 need not be for real time communications in preferred embodiments, although it may be used for that purpose in alternative embodiments of this invention.

Within the IP network of the UTRAN 57, nodes are identified by network layer addresses such as IP addresses. These addresses provide a simple mechanism for identifying the source and destination of messages within the IP network. For example, an IP address may be a 32-bit (or more) binary number with a format of four or more bytes, divided between four or more eight-bit parts. Typically, each byte of an IP address is a number from 0 to 255, with one part of the address identifying the network

or subnetwork and another part the node. Exemplary IP addresses are shown in Figure 7.

Figure 5 illustrates a plurality of cells defined in a known manner by respective base stations (BSs) 63 of the Figure 4 UTRAN. Cells A-I are illustrated in the from of squares for purposes of simplicity only. As illustrated, each base station 63 defines its own cell which is a particular geographic area serviced by that base station. Thus, as will be appreciated by those of skill in the art, it is known that base stations 63 in a cellular telecommunications network are geographically separated by distances relating to the respective cells formed by respective base stations 63.

Figure 6 illustrates the protocol stack of an exemplary node (e.g., RNC and/or BS) of UTRAN 57 after the node has been configured. The node behaves conceptually as a multi-homed host and a router (e.g., OSPF router). When configured as a router, a router protocol application can be connected to the stack via, for example, a raw socket interface. Open Shortest Path First (OSPF) Interior Gateway Protocol (OSPFIGP) is a known ASPF specific protocol used to propagate network reachability and routing information within a OSPF system. In other embodiments, a Boarder Gateway Protocol (BGP) may instead to used as a router protocol. Such protocols and respective applications shown in Figure 6 are stored in corresponding memory locations of the node.

Still referring to Figure 6, applications of a particular node can be reached with addresses of attached interfaces (e.g., IP or Mac addresses). The configuration data of the node determines how interfaces are attached to the IP stack. As shown, it is possible to configure one Ethernet interface and a plurality of different ATM interfaces. Virtual Path Identifiers (VPI) and Virtual Circuit Identifiers (VCI) are known fields of an ATM connection identifier. The illustrated node is further configured with data defining the operation of Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) transport services. Each of these is known in the art. UDP is a protocol layer above IP, which provides a less reliable but more efficient datagram service. The service is available to applications via the socket interface. Examples of utilities which may use this service include DHCP, TFTP, FTP, and BOOTP.

As shown in Figure 6, certain types of basic communication between respective nodes in the UTRAN are provided by point-to-point links based upon ATM connections via respective ATM interfaces. Each such point-to-point link between nodes may utilized a pair of Virtual Channels (VC), intended for high and low prioritized traffic. IP messages communicated between nodes may be packed in LLC/AAL 5 frames using VP/VC ATM connections. ATM Adaption Layer 5 (AAL 5) is a protocol above ATM used to send data packets across an ATM network.

Figure 7 is a schematic diagram illustrating how an embodiment of this invention may be utilized in order to initially configure a new node 3 (e.g., BS 63 or RNC 61) upon the new node's connection to the UTRAN 57. Included in the network are network management node (NMN) 7, root node 65, a plurality of RNC nodes 61, a plurality of base station nodes 63, new node 3 (e.g., a base station or RNC) to be added to the network and initially configured, LMT (or ICT) 5, GPS satellite system 4, and communications media 8. The new node 3 is connected to the network with interface links 71 and 73 (e.g., ATM connections). The network of Figure 7 is basically tree-shaped, so that uplink and downlink relations between nodes may be defined.

Each node of the Fig. 7 network may have a primary uplink interface (e.g., 71 and/or 73 regarding node 3) through which a network connection can typically be established (e.g., a type of ATM connection or point-to-point link). Via a primary uplink interface of a node, the node can reach specific management nodes (e.g., 7, 65, etc.). Each node by default may support the OSPFIGP routing protocol. However, upon initially being connected to the network, new node 3 does not have an IP address, may not have a site identifier, and may not have a configured ATM communication layer. Thus, new node 3 must be at least initially configured before it can properly function within the Figure 7 network.

In this regard, a technician brings LMT (or ICT) 5 into the field and locates the LMT proximate the geographic location of new node 3 (e.g., when new node 3 is a base station, the LMT is preferably positioned within the station's cell and preferably close to the base station itself). The technician then causes LMT 5 to access the GPS satellite system 4 in order to determine geographic location of the LMT. LMT 5 provides NMN

7 with its position data via communications media 8. NMN 7, using the geographic position of the LMT, determines the ID of the new node and determines (e.g., looks up in a look-up table/memory) the initial configuration data for the same. NMN 7 then forwards the appropriate initial configuration data for the new node to LMT 5 via communications media 8. LMT 5 receives the initial configuration data, and sends it on to new node 3 via interface 2.

The initial configuration data for the new node may include, for example and without limitation, new IP addresses 10.0.8.2 and 10.0.8.6 (as shown in Figure 7) for the respective ATM connections 71, 73 of the new node. Other information such as a site identifier, ATM communication layer, etc. may also be included in the initial configuration data sent from LMT 5 to new node 3. In such a manner, new node 3 may be initially configured with a reduced likelihood of technician error during the initial configuration process.

After being initially configured in such a manner, new node 3 may utilize at least part of its initial configuration data (e.g., its IP address(es)) in order to access other node(s) in the cellular telecommunications network in order to, e.g., perform additional configuration for the new node. The new IP addresses shown in Figure 7 may be utilize so that the new node may communicate with other nodes in the network via ATM links 71 and 73 in order to download, for example, additional configuration data. For example, once initially configured the new node 3 may communicate with root node 65 via ATM links 71, 72 and 74, and with another management node (not shown) in the Ethernet LAN 76 of node 65 in order to download additional router configuration data therefrom. In other embodiments, after being initially configured the new node 3 may communicate with a DHCP server via an ATM connection in order to receive DHCP configuration information therefrom.

In alternative embodiments, the LMT may determine its position (e.g., via GPS, GSM, or any other suitable type of geographic positioning system) and use its position information to itself look-up or otherwise determine initial configuration data for the new node to be initially configured. Then, the LMT can simply forward the initial configuration data to the new node in order to initially configure the same. This

embodiment potentially avoids the need for network management node participation in the initial configuration process.

Figure 9 illustrates another embodiment of this invention that is similar to those discussed above, except that geographic positioning sensor or detector 93 (where sensor 93 is in communication with LMT 5) is located proximate new node 3. This enables the LMT 5 to either be (a) located proximate the new node, or (b) located distant or remote from the new node as shown in Fig. 9. Thus, greater flexibility is provided because the LMT itself need not be transported to locations proximate all new nodes, and a smaller sensor 93 could instead be so transported so long as the sensor 93 is in communication with the LMT (e.g., via PSTN line, via radio interface, via cellular telecommunications network, via ATM system, or any other suitable communications interface/system). The Fig. 9 embodiment differs from those discussed above only in this regard, and also in that the position of the sensor 93 is used to determine which new node is being configured as opposed to the position of the LMT itself (this difference may or may not be transparent to the management node). The geographic position sensor or detector 93 may be, for example, a GPS transceiver, any type of device that is capable itself of determining its geographic position with the aid of the GPS, GSM, or other system, or may also be any type of device that merely receives information from a positioning system (e.g., GPS or GSM type system) and forwards the same to a remote device (e.g., the LMT) so that the remote device can determine the position of the sensor/detector 93.

Accordingly, certain advantages are realized by exemplary embodiments of this invention. These advantages include one or more of the following: a) minimum risk for human error during initial configuration, b) little training is required for the operator/technician who carries out initial configuration using the LMT (e.g., one who installs the new node may also perform initial configuration), c) a reduced or minimum number of manual operations is required, d) physical connections at the site of the new node need not be required for initial configuration because radio media may be utilized, and/or e) faster time to market with new nodes. It is noted that new nodes herein are

initially configured upon their connection to a network; this includes initial configuration both before and after a new node is actually connected to a network.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments. To the contrary, the invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. For example, while this invention may be used in the context of new nodes being connected to the network for the first time, the invention may also be used in the context of nodes which are being connected to the network after having been repaired or taken off line. All such nodes are considered "new" nodes herein. Moreover, certain embodiments of this invention may be applicable to networks other than cellular telecommunication networks.

**WHAT IS CLAIMED IS:**

1. A method of initially configuring a new node of a network, the method characterized by:

locating an initial configuration terminal proximate the new node of the network, so that the initial configuration terminal is located geographically closer to the new node than to any other node of the network;

determining a position of the initial configuration terminal;

sending position data relating to the position of the initial configuration terminal to a management node;

the management node receiving the position data and using at least the position data to determine initial configuration data for the new node;

the management node sending the initial configuration data for the new node to the initial configuration terminal; and

the initial configuration terminal receiving the initial configuration data and sending the initial configuration data to the new node so that the new node may be initially configured.

2. The method of claim 1, further characterized in that said determining a position of the initial configuration terminal step comprises using one of GPS and GSM in order to determine the position of the initial configuration terminal.

3. The method of claim 1, further characterized in that the initial configuration terminal is portable, and the terminal includes a computer, a display, and a GPS receiver.

4. The method of claim 1, further characterized by:

once initially configured, the new node using at least a portion of the initial configuration data to access a node in the network in order to fetch or obtain further configuration data.

5. The method of claim 1, further characterized in that the new node comprises one of a base station (BS) and a radio network controller (RNC) of a cellular telecommunications network.

6. The method of claim 1, further characterized in that the initial configuration data includes at least one of an IP address, a site identifier, and an ATM layer configuration.

7. A method of initially configuring a node, the method characterized by:

locating a geographic position sensor or detector proximate the node;

determining a position of the sensor or detector;

using at least the position of the sensor or detector to determine initial configuration data for the node; and

initially configuring the node using the initial configuration data.

8. The method of claim 7, further characterized in that said step of using at least the position of the sensor or detector to determine initial configuration data for the node, is performed by an initial configuration terminal, wherein the sensor or detector is either (a) part of the initial configuration terminal or (b) is in communication therewith a located remotely therefrom.

9. The method of claim 7, further characterized in that said step of using at least the position of the sensor or detector to determine initial configuration data for the node, is performed by a management node with which an initial configuration terminal is in communication.

10. The method of claim 7, further characterized in that said step of determining a position of the sensor or detector comprises using GPS or GSM to determine the position.

11. The method of claim 7, further characterized by:

once initially configured, the node using at least a portion of the initial configuration data to access another node in the network in order to fetch or obtain further configuration data.

12. The method of claim 7, further characterized in that the node comprises one of a base station (BS) and a radio network controller (RNC) in a cellular telecommunications network.

13. The method of claim 7, further characterized in that the initial configuration data includes at least one of an IP address, a site identifier, and an ATM layer configuration.

14. An initial configuration terminal for initially configuring a node to be configured, the initial configuration terminal comprising a processor, a memory, and a display, the initial configuration terminal being characterized by:

a receiver for use in determining a geographic position of the initial configuration terminal;

wherein the initial configuration terminal includes a communications interface for forwarding position data indicative of the terminal's geographic position to a remote management node and for receiving initial configuration data from the management node for the node to be configured; and

wherein the initial configuration terminal includes an interface for sending initial configuration data to the node to be configured.

15. The terminal of claim 14, further characterized in that the initial configuration data includes at least one of an IP address, a site identifier, and an ATM layer configuration.

16. A method of initially configuring a new node of a network, the method being characterized by:

locating geographic positioning sensor proximate the new node of the network, so that the geographic positioning sensor is located geographically closer to the new node than to any other node of the network;

determining a position of the geographic positioning sensor;

sending position data relating to the position of the geographic positioning sensor to a management node;

the management node receiving the position data and using at least the position data to determine initial configuration data for the new node; and

the new node being initially configured in accordance with the initial configuration data.

17. The method of claim 16, further characterized by:

providing an initial configuration terminal that is in communication with the geographic position sensor;

the management node sending the initial configuration data for the new node to the initial configuration terminal; and

the initial configuration terminal receiving the initial configuration data and sending the initial configuration data to the new node so that the new node may be initially configured.

18. An initial configuration terminal for initially configuring a node to be configured, the initial configuration terminal comprising a processor, a display, and a memory, and being characterized by:

a geographic position sensor or detector that is either part of the terminal or is located remotely from the terminal and is in communication therewith, the sensor or detector for use in determining a geographic position of the sensor or detector;

wherein the initial configuration terminal includes a communications interface for forwarding position data indicative of the geographic position of the sensor or terminal to a remote management node and for receiving initial configuration data from the management node for the node to be configured; and

wherein the initial configuration terminal includes an interface for sending initial configuration data to the node to be configured.

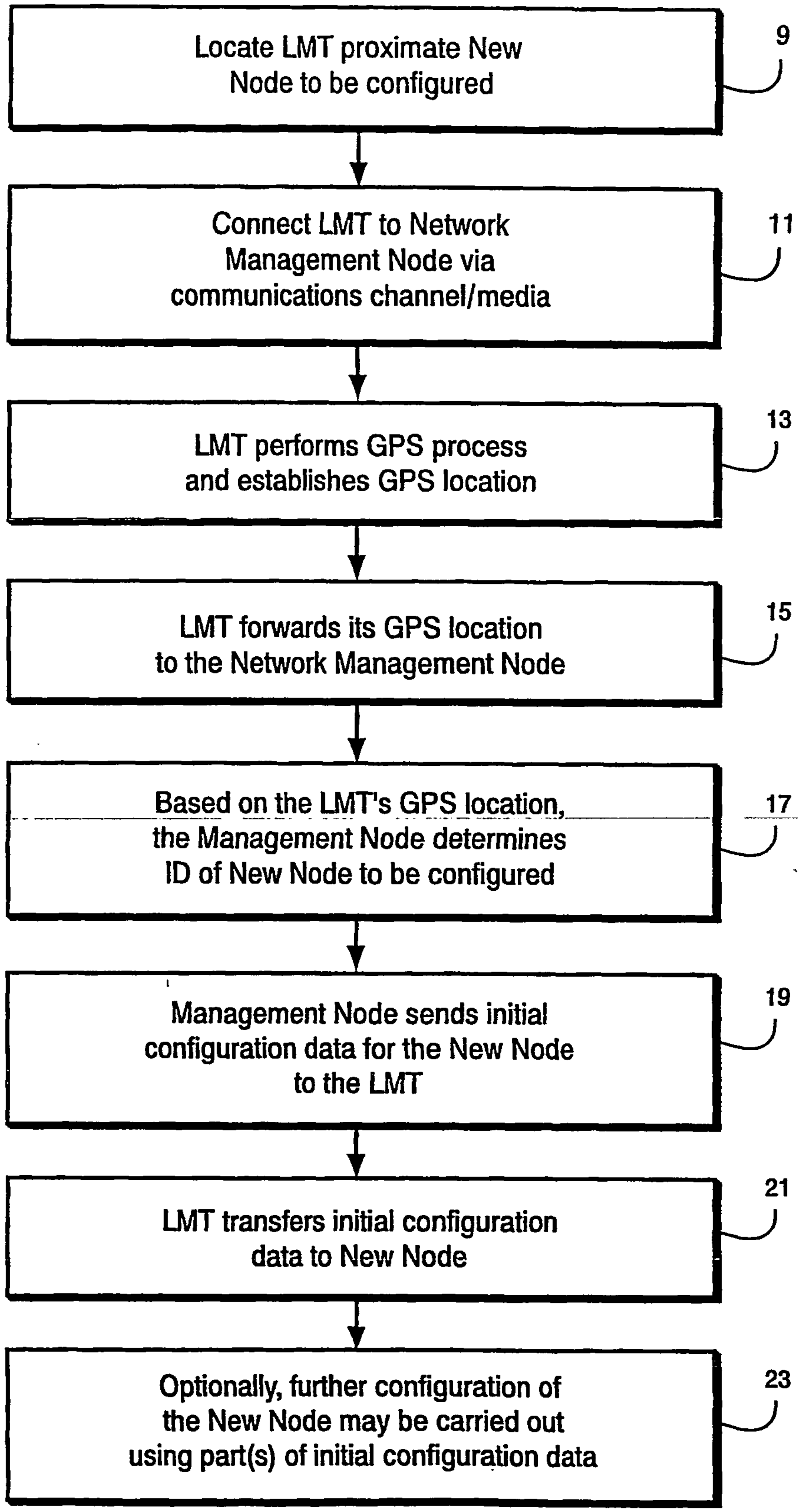

Locate LMT proximate New Node to be configured
9
Connect LMT to Network Management Node via communications channel/media
11
LMT performs GPS process and establishes GPS location
13
LMT forwards its GPS location to the Network Management Node
15
Based on the LMT's GPS location, the Management Node determines ID of New Node to be configured
17
Management Node sends initial configuration data for the New Node to the LMT
19
LMT transfers initial configuration data to New Node
21
Optionally, further configuration of the New Node may be carried out using part(s) of initial configuration data
23

**Fig. 1**

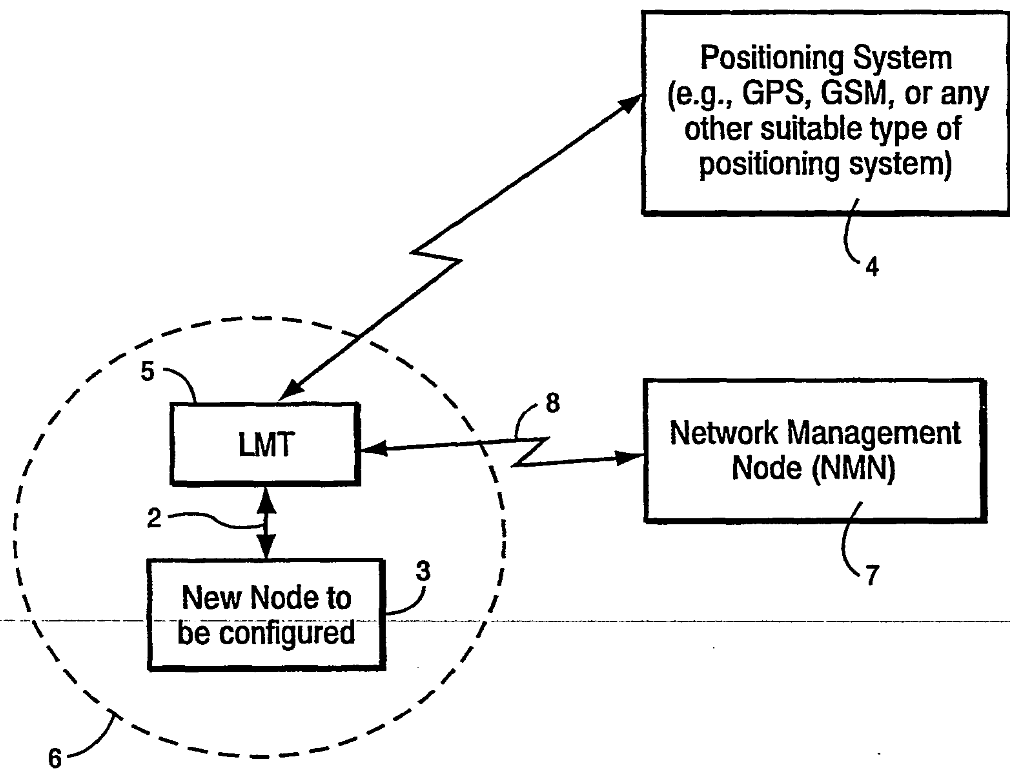

Positioning System
(e.g., GPS, GSM, or any
other suitable type of
positioning system)
4
5
8
LMT
Network Management
Node (NMN)
2
3
New Node to
be configured
7
6

Fig. 2

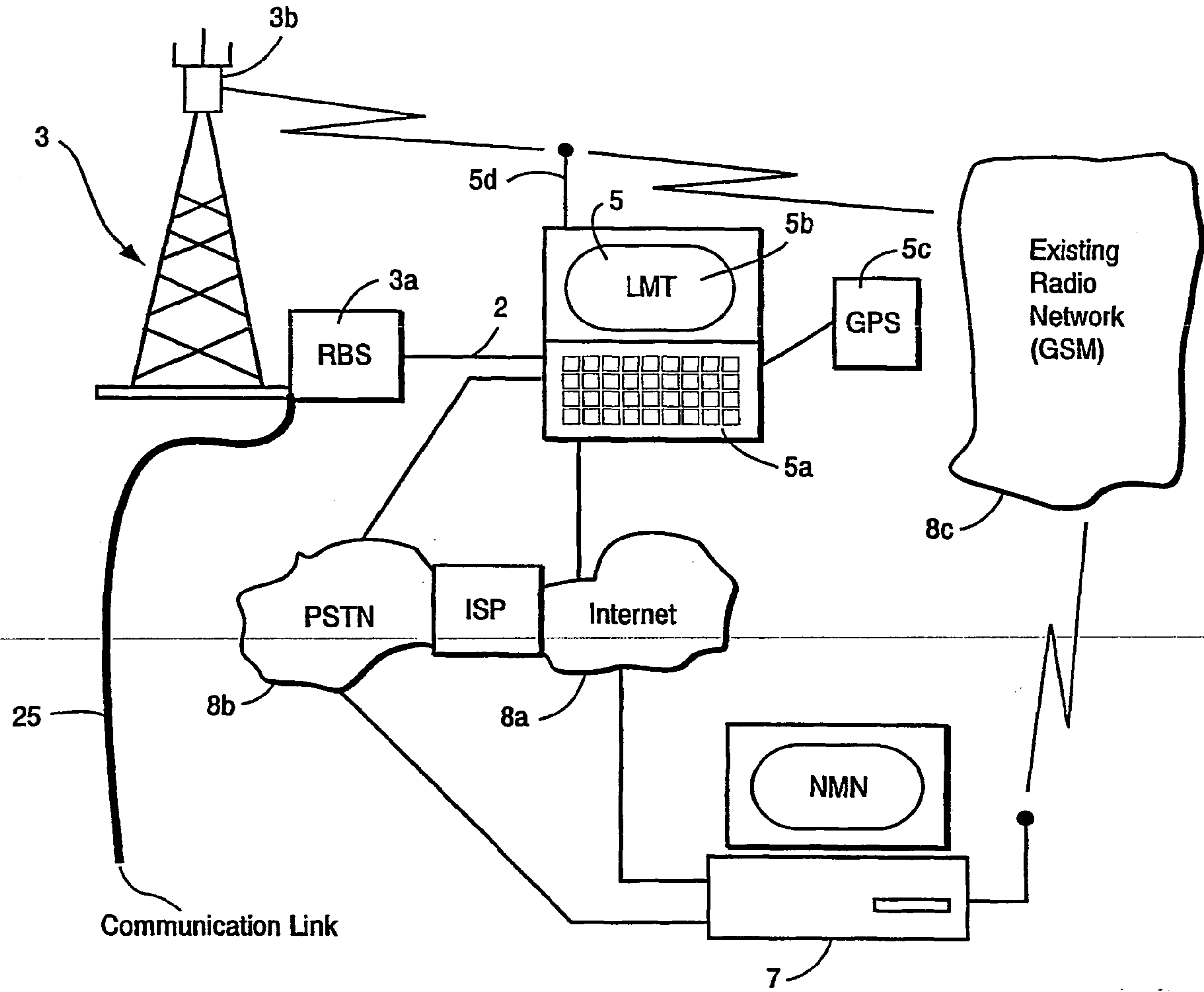

3b
3
5d
5
5b
5c
LMT
GPS
3a
2
RBS
Existing
Radio
Network
(GSM)
5a
8c
PSTN
ISP
Internet
25
8b
8a
NMN
Communication Link
7

Fig. 3

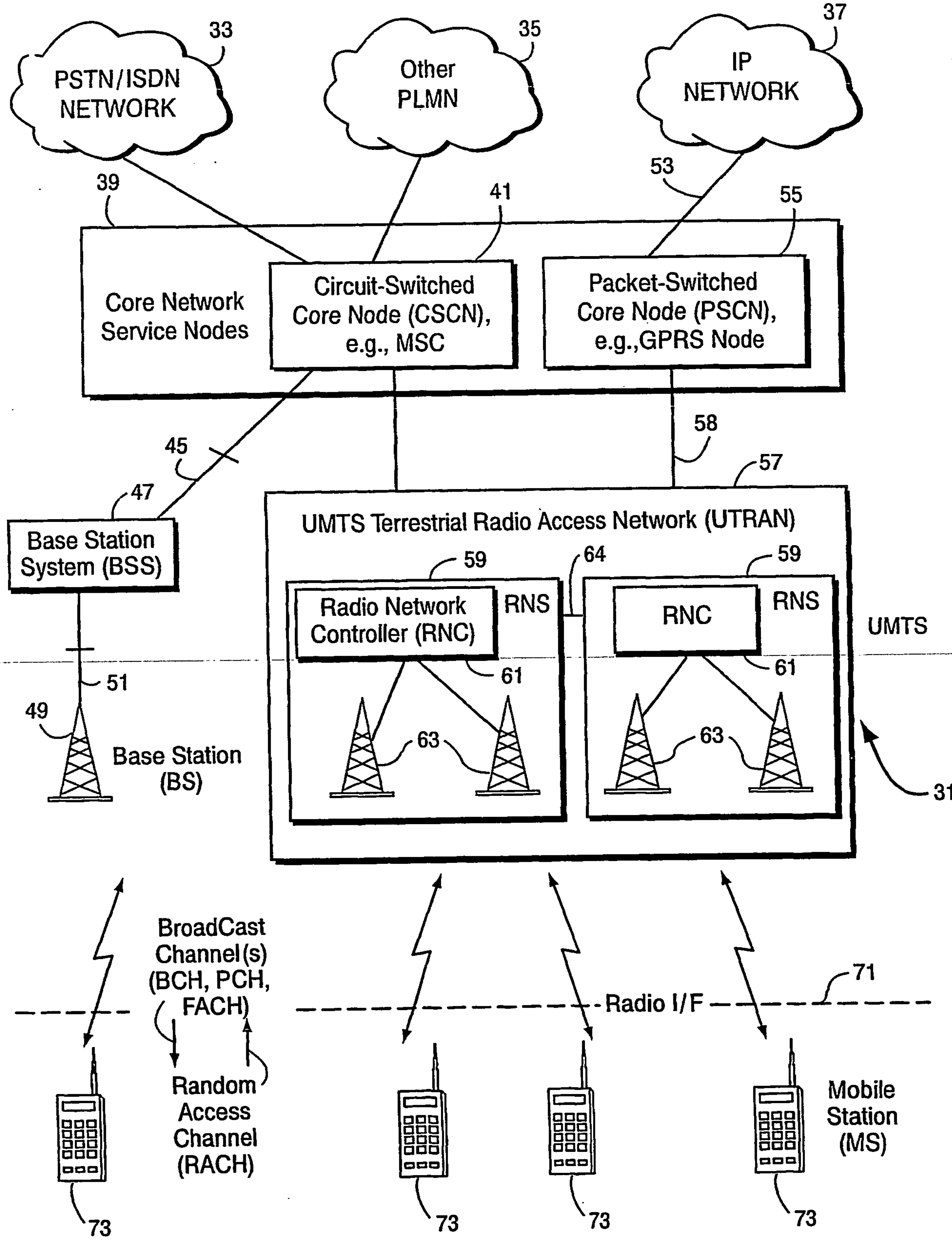

PSTN/ISDN NETWORK
33
Other PLMN
35
IP NETWORK
37
39
41
53
55
Core Network Service Nodes
Circuit-Switched Core Node (CSCN), e.g., MSC
Packet-Switched Core Node (PSCN), e.g.,GPRS Node
45
47
58
57
Base Station System (BSS)
UMTS Terrestrial Radio Access Network (UTRAN)
59
64
59
Radio Network Controller (RNC)
RNS
RNC
RNS
UMTS
51
61
61
49
Base Station (BS)
63
63
31
BroadCast Channel(s) (BCH, PCH, FACH)
71
Radio I/F
Random Access Channel (RACH)
Mobile Station (MS)
73
73
73
73

Fig. 4

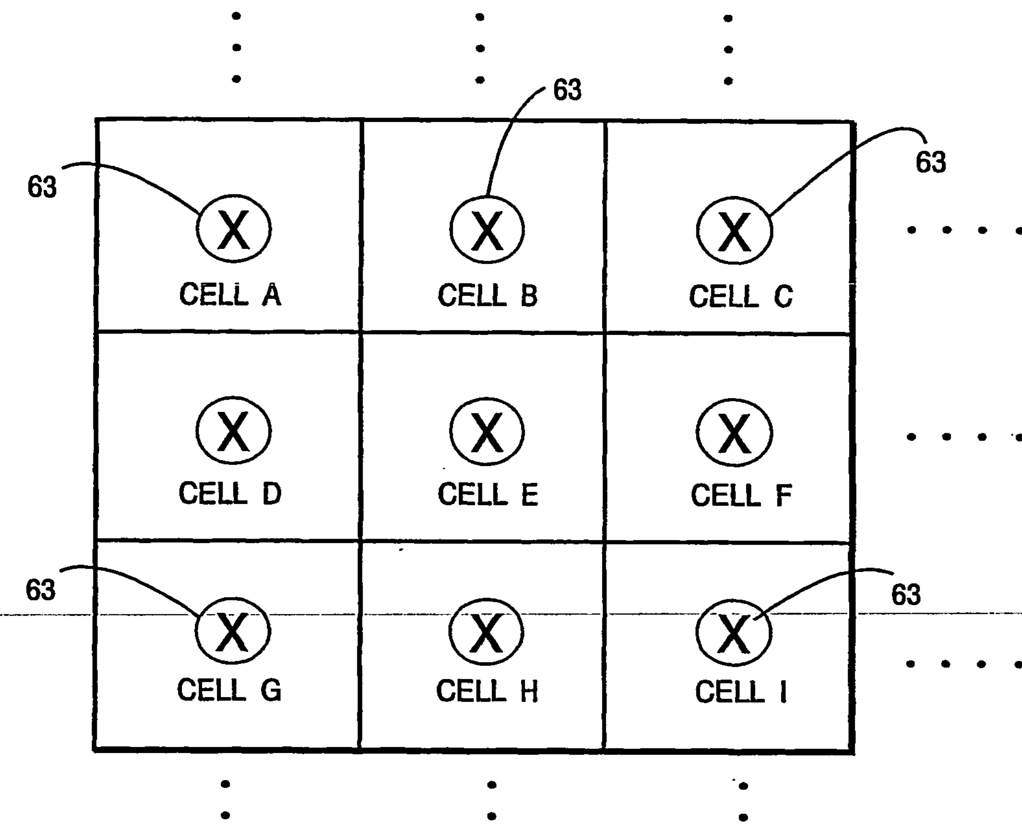

63
63
63
63
63
63
CELL A
CELL B
CELL C
CELL D
CELL E
CELL F
CELL G
CELL H
CELL I

Fig. 5

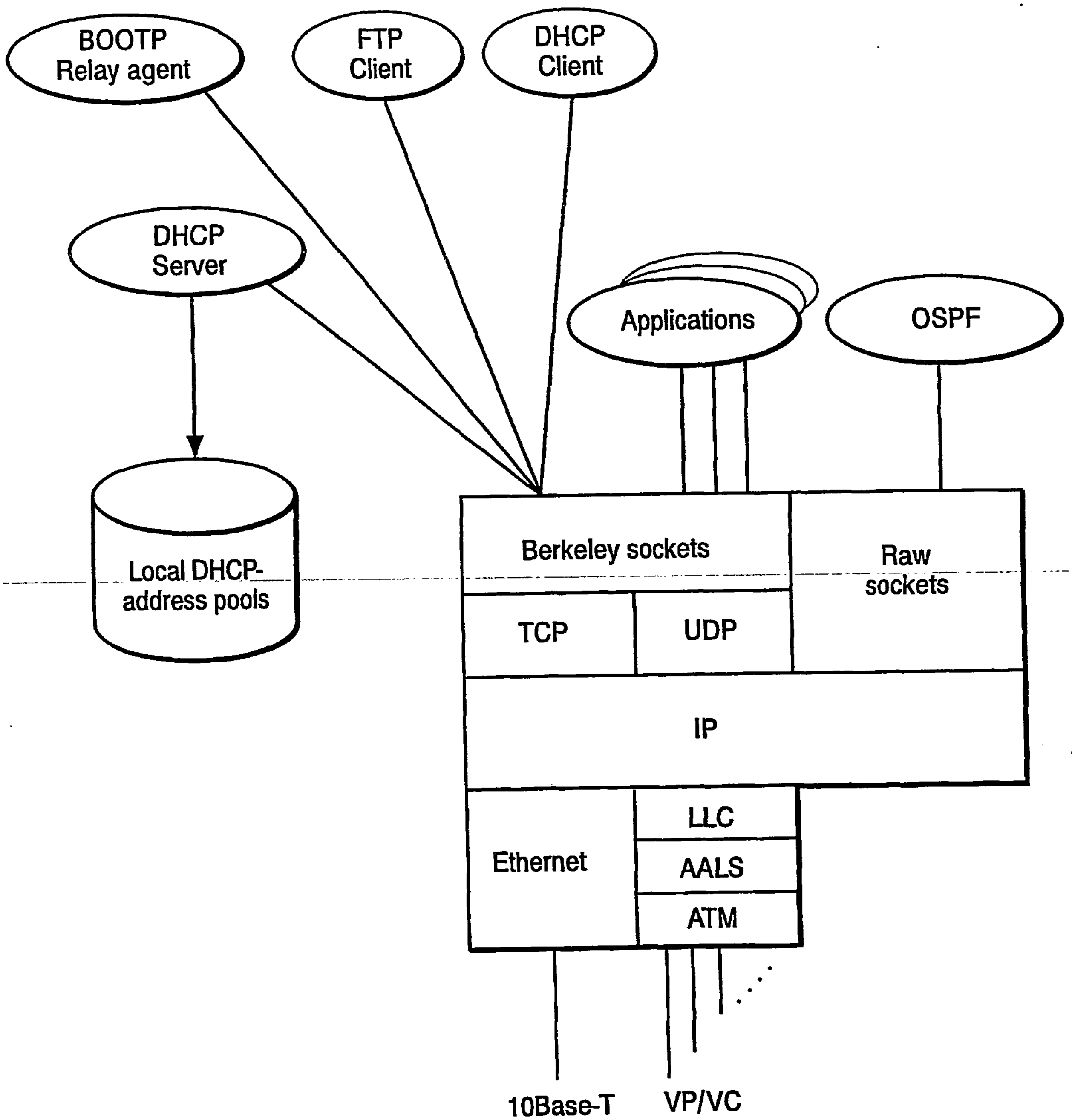
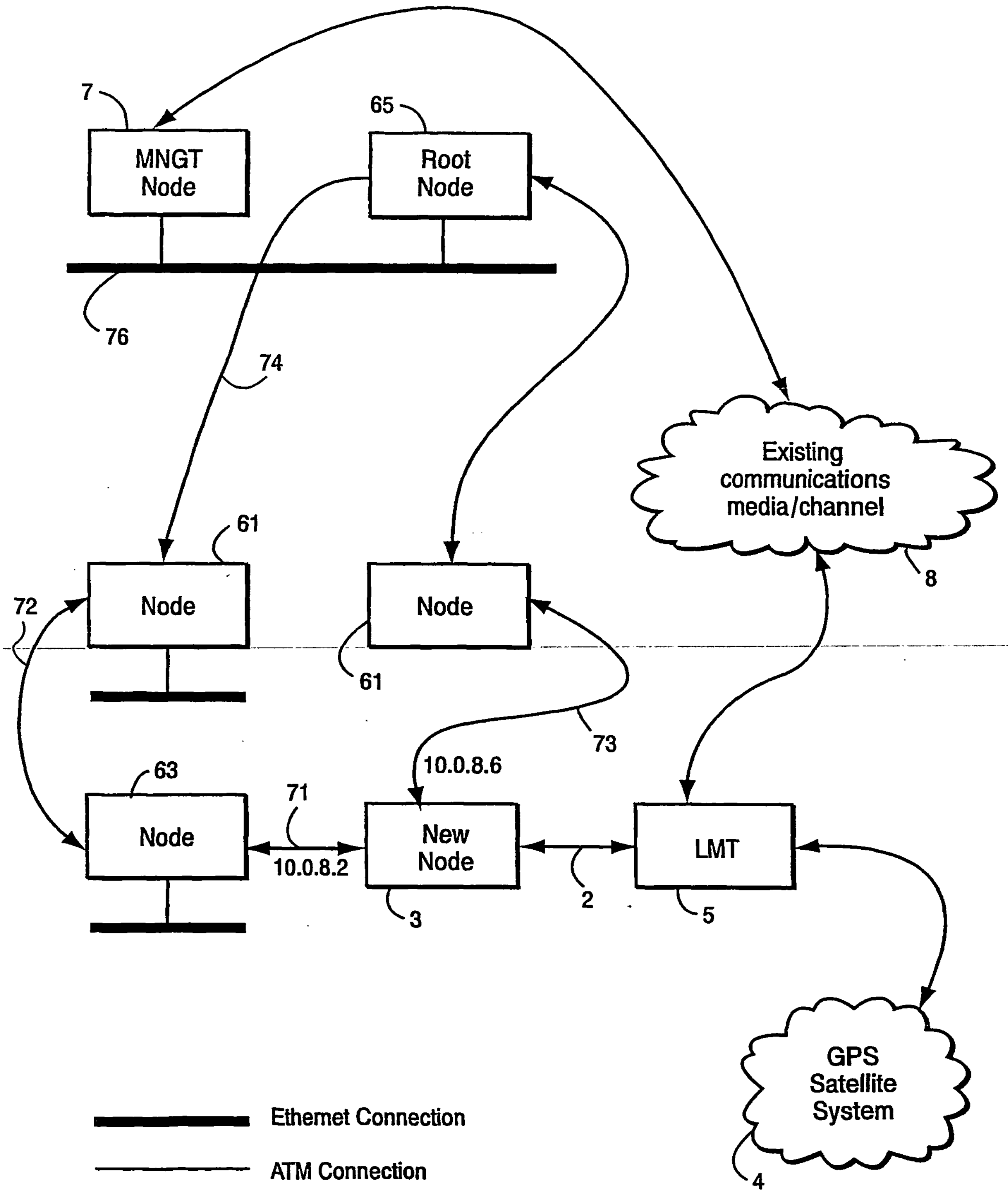

BOOTP
Relay agent
FTP
Client
DHCP
Client
DHCP
Server
Local DHCP-
address pools
Applications
OSPF
Berkeley sockets
Raw
sockets
TCP
UDP
IP
Ethernet
LLC
AALS
ATM
10Base-T
VP/VC

**Fig. 6**



7
MNGT Node
65
Root Node
76
74
Existing communications media/channel
8
72
61
Node
Node
61
73
10.0.8.6
63
Node
71
10.0.8.2
New Node
3
2
LMT
5
GPS Satellite System
4
Ethernet Connection
ATM Connection


Fig. 7

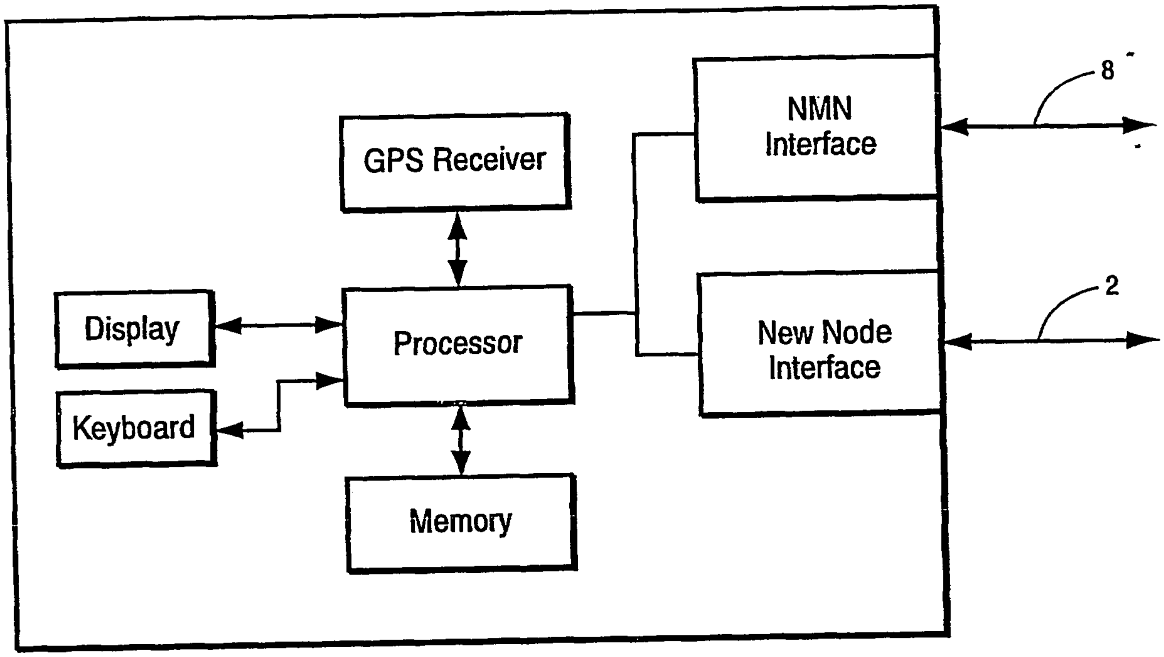

GPS Receiver
NMN Interface
8
Display
Processor
New Node Interface
2
Keyboard
Memory

Fig. 8

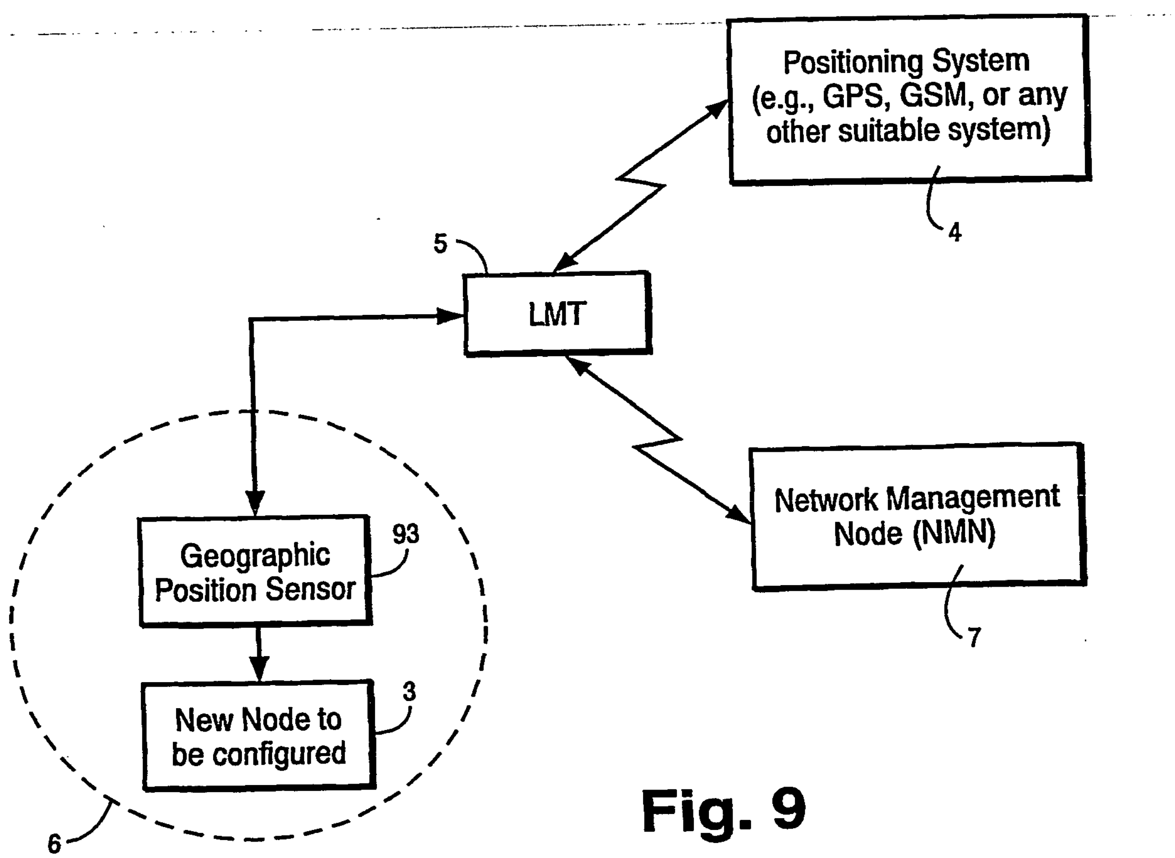

Positioning System (e.g., GPS, GSM, or any other suitable system)
4
5
LMT
Geographic Position Sensor
93
Network Management Node (NMN)
7
New Node to be configured
3
6

Fig. 9

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/SE 01/01633

**A. CLASSIFICATION OF SUBJECT MATTER**
IPC 7 H04Q7/34

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | WO 99 43174 A (QUALCOMM INC)<br>26 August 1999 (1999-08-26)<br>page 6, line 8 -page 9, line 17<br>--- | 1-18 |
| Y | EP 0 814 346 A (AT & T CORP)<br>29 December 1997 (1997-12-29)<br>cited in the application<br>column 2, line 51 -column 3, line 54<br>----- | 1-18 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 20 December 2001 | 02/01/2002 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Lõpez Pérez M-C. |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/SE 01/01633

| Patent document cited in search report | | Publication date | Patent family member(s) | | | Publication date |
|---|---|---|---|---|---|---|
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| | | | BR | 9908159 | A | 07-11-2000 |
| | | | CN | 1292205 | T | 18-04-2001 |
| | | | EP | 1057354 | A1 | 06-12-2000 |
| | | | WO | 9943174 | A1 | 26-08-1999 |
| EP 0814346 | A | 29-12-1997 | US | 5706014 | A | 06-01-1998 |
| | | | CA | 2197732 | A1 | 19-12-1997 |
| | | | CN | 1174331 | A | 25-02-1998 |
| | | | EP | 0814346 | A1 | 29-12-1997 |
| | | | JP | 10070506 | A | 10-03-1998 |

Form PCT/ISA/210 (patent family annex) (July 1992)